Is there ice on the Moon?

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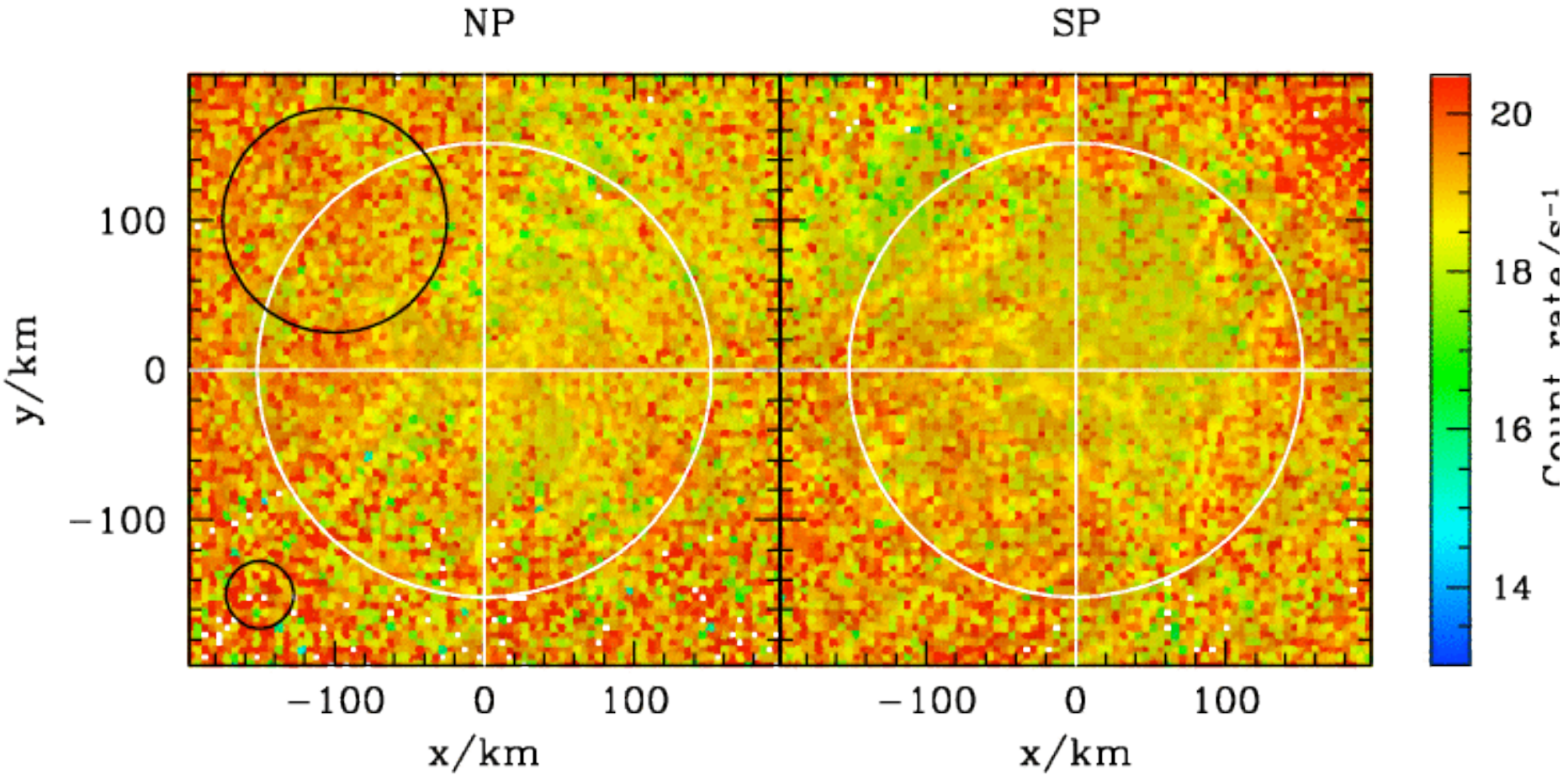
Lunar Prospector data



The problem: D=T*B+N

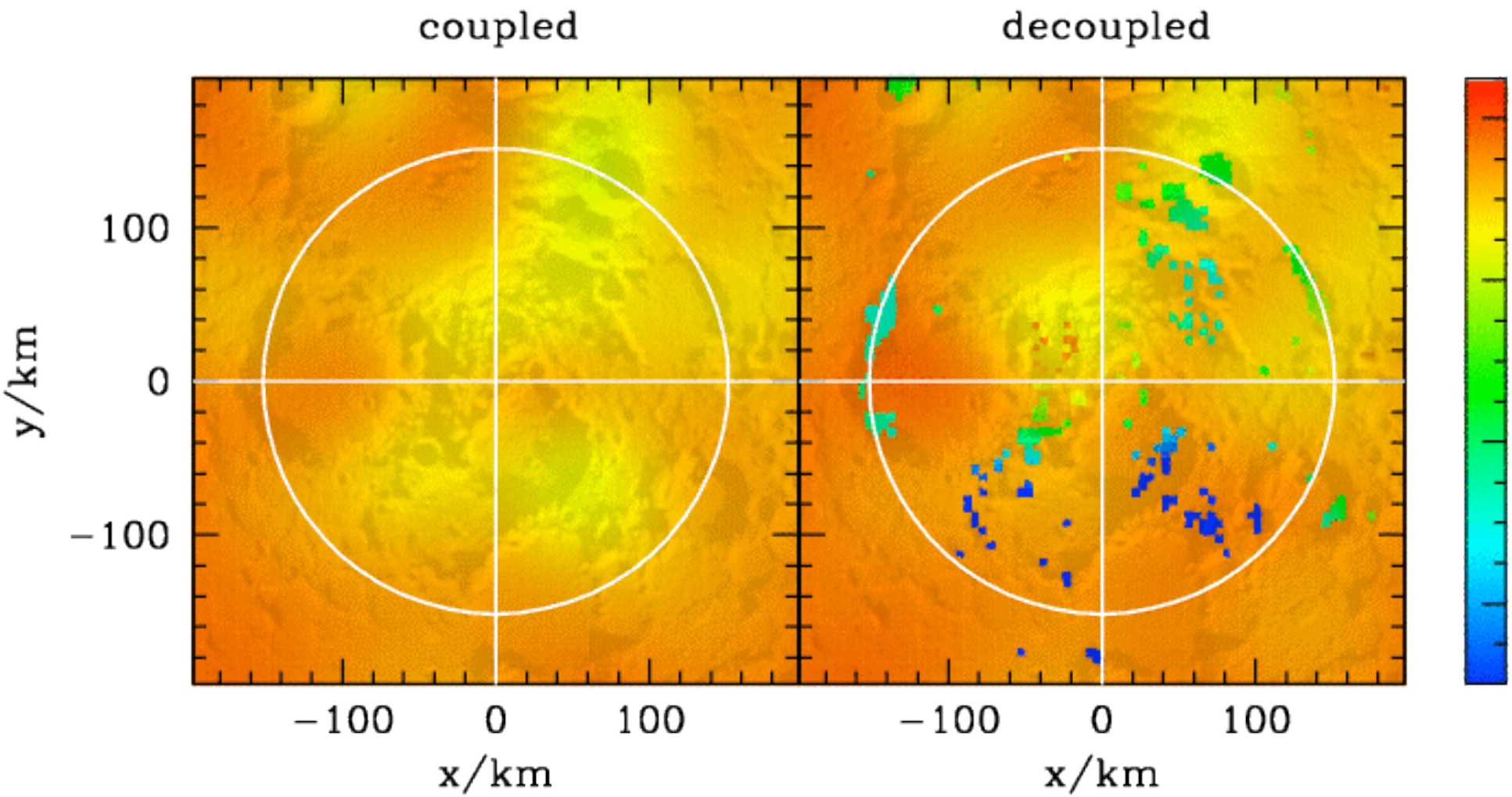
Noise makes the problem ill-posed.

Define $R = D - T_e * B.$

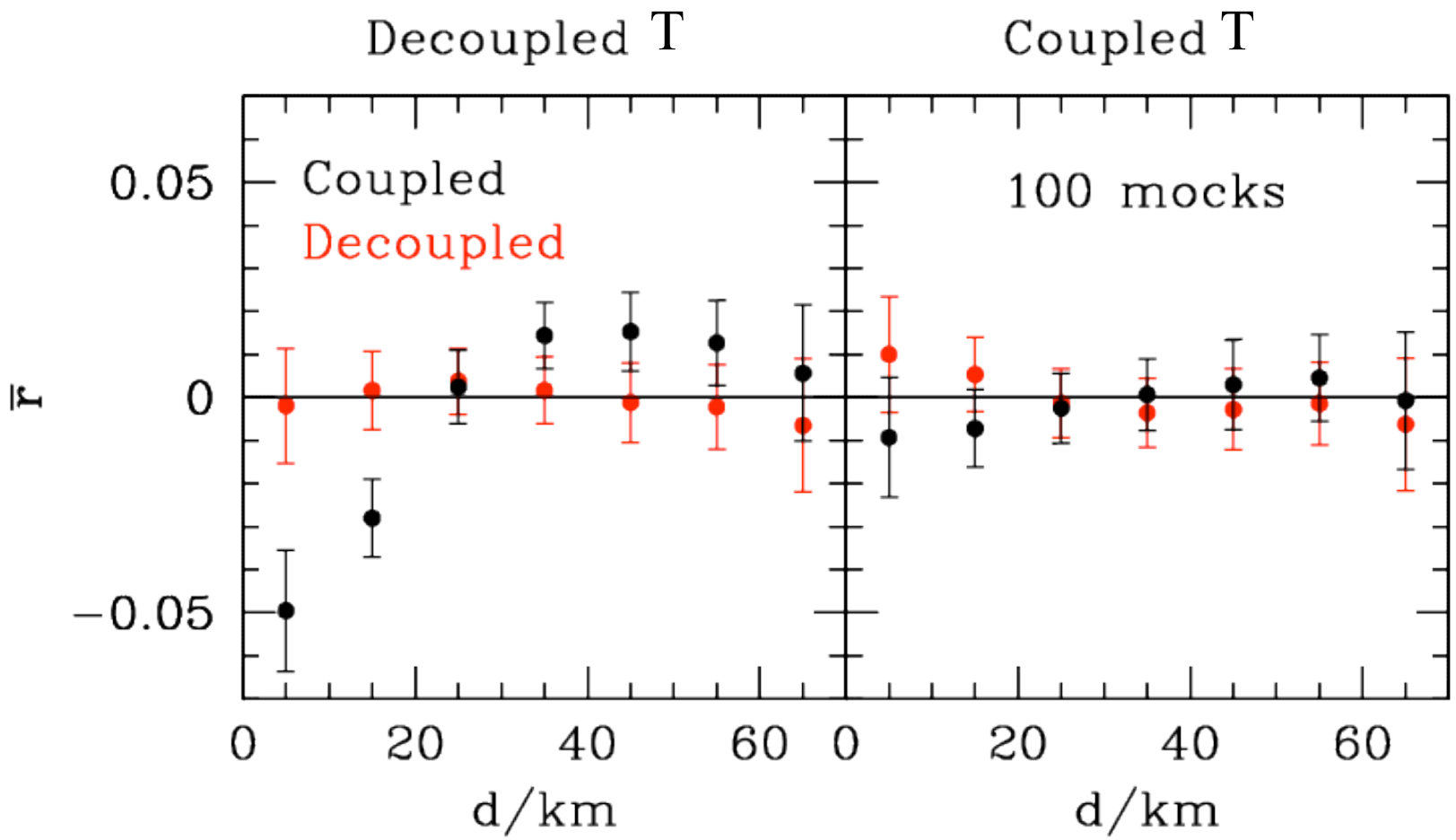
Find a good fit with no details that the data don't demand.

Pixon-based image reconstruction.

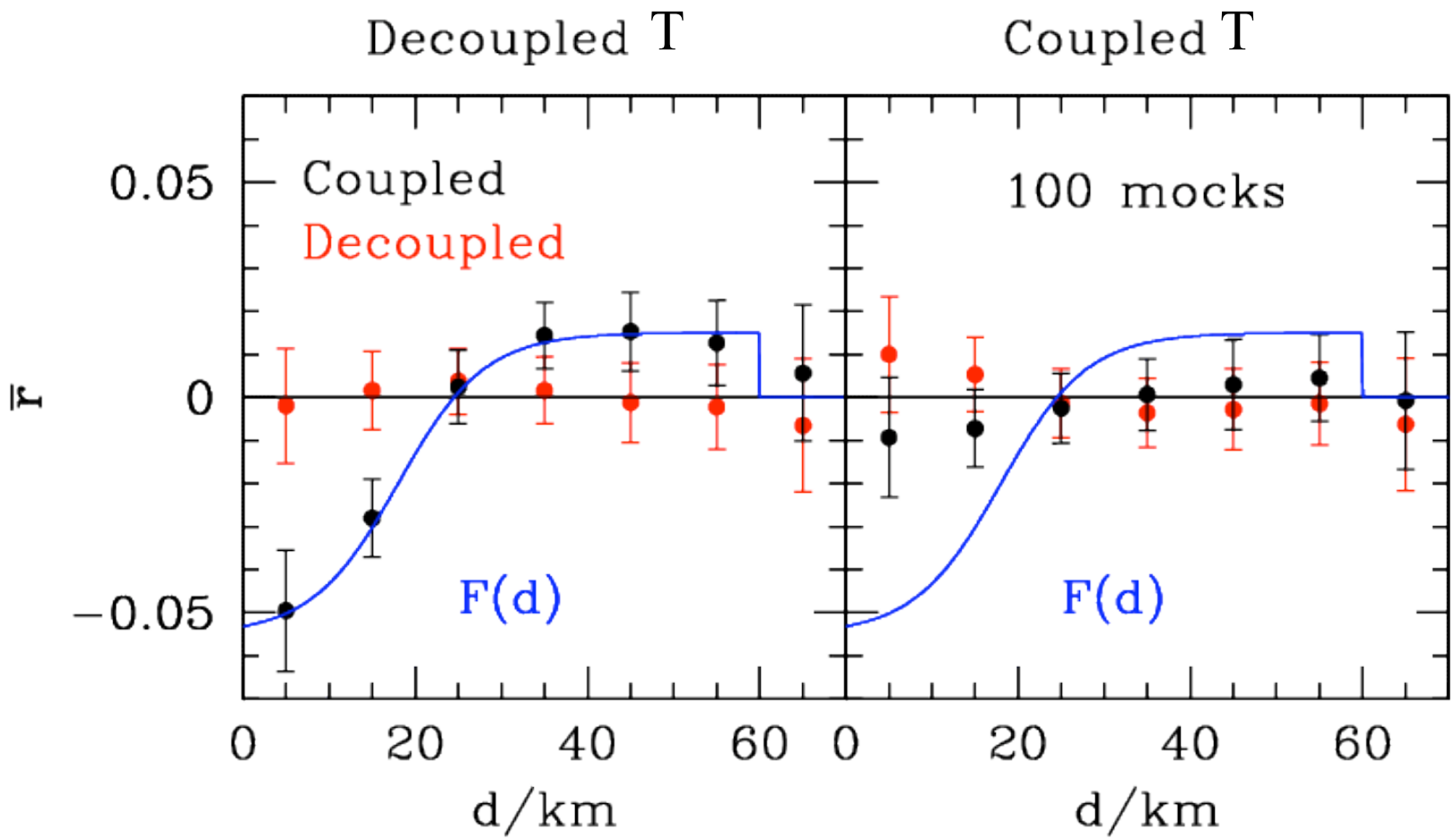
North Pole reconstructions



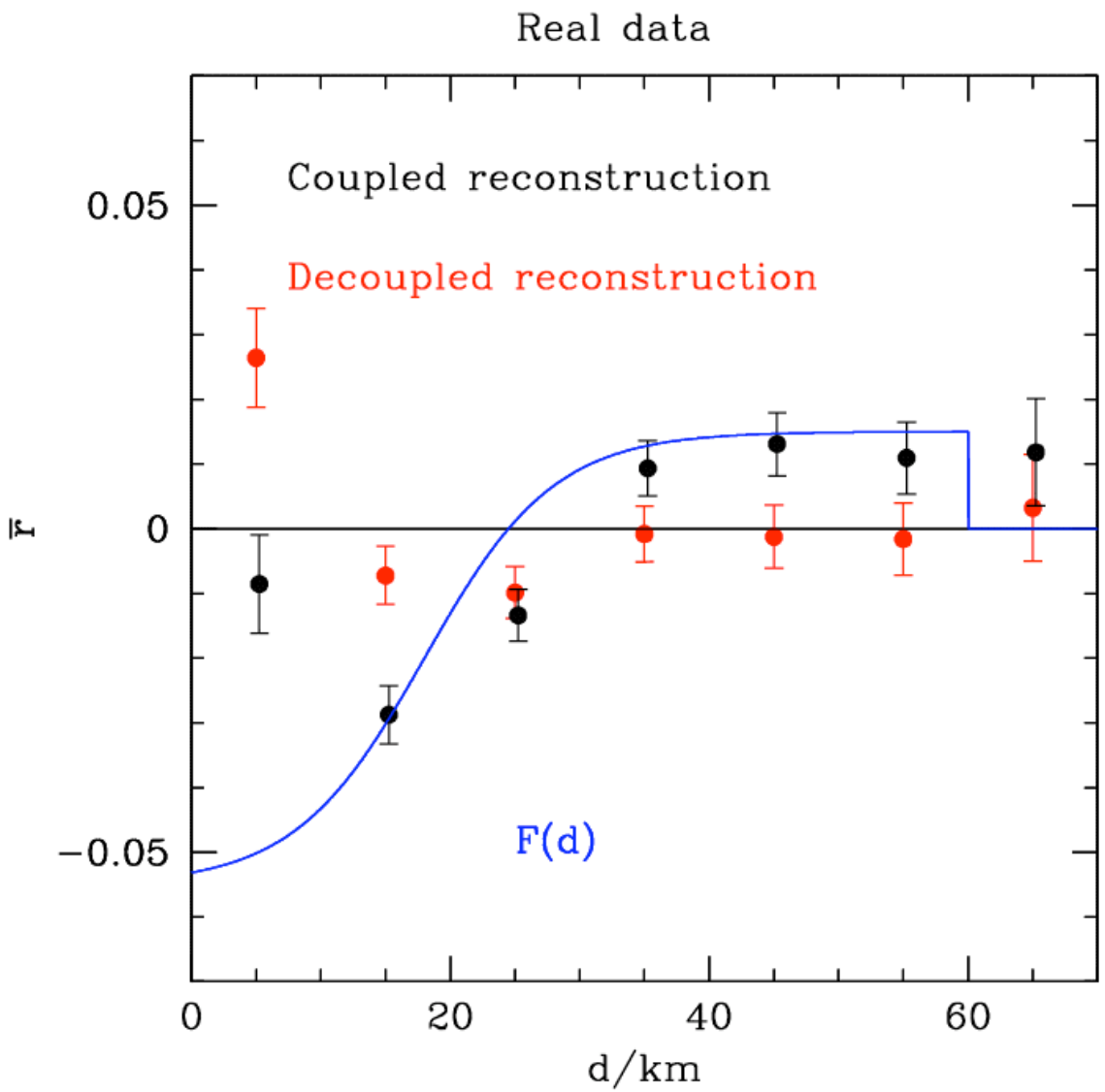
Stacked reduced residuals



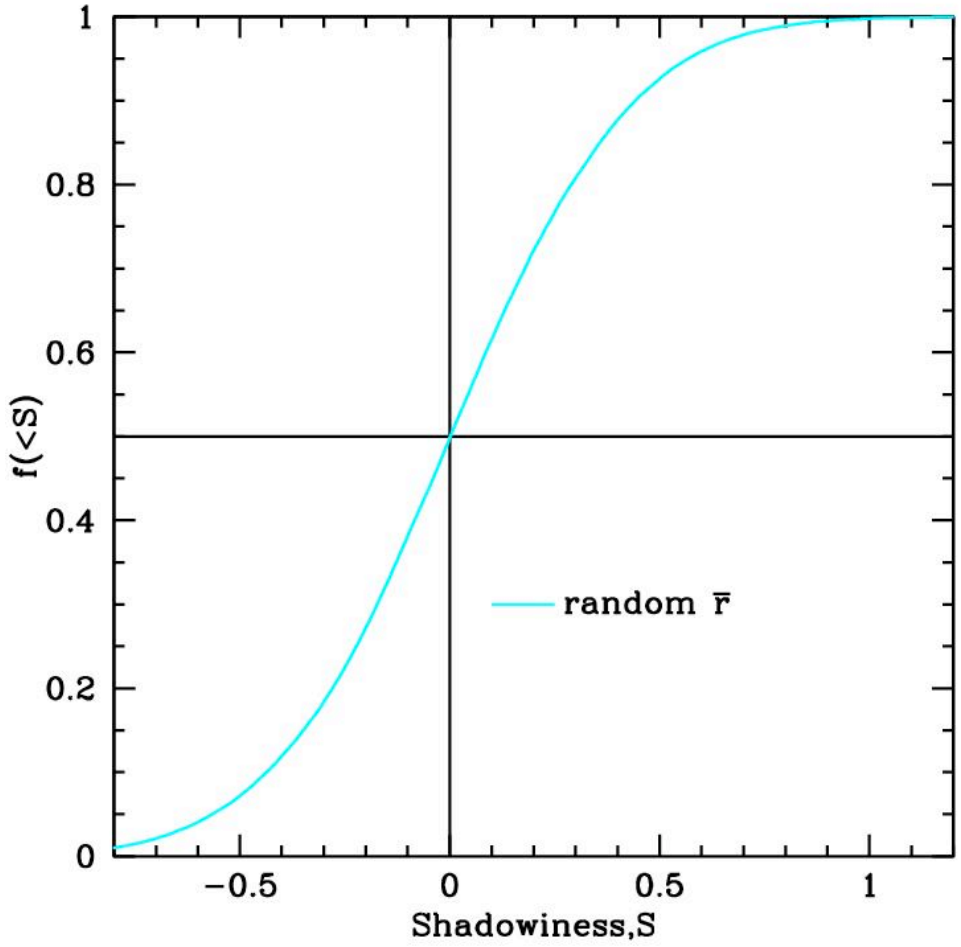
Stacked reduced residuals



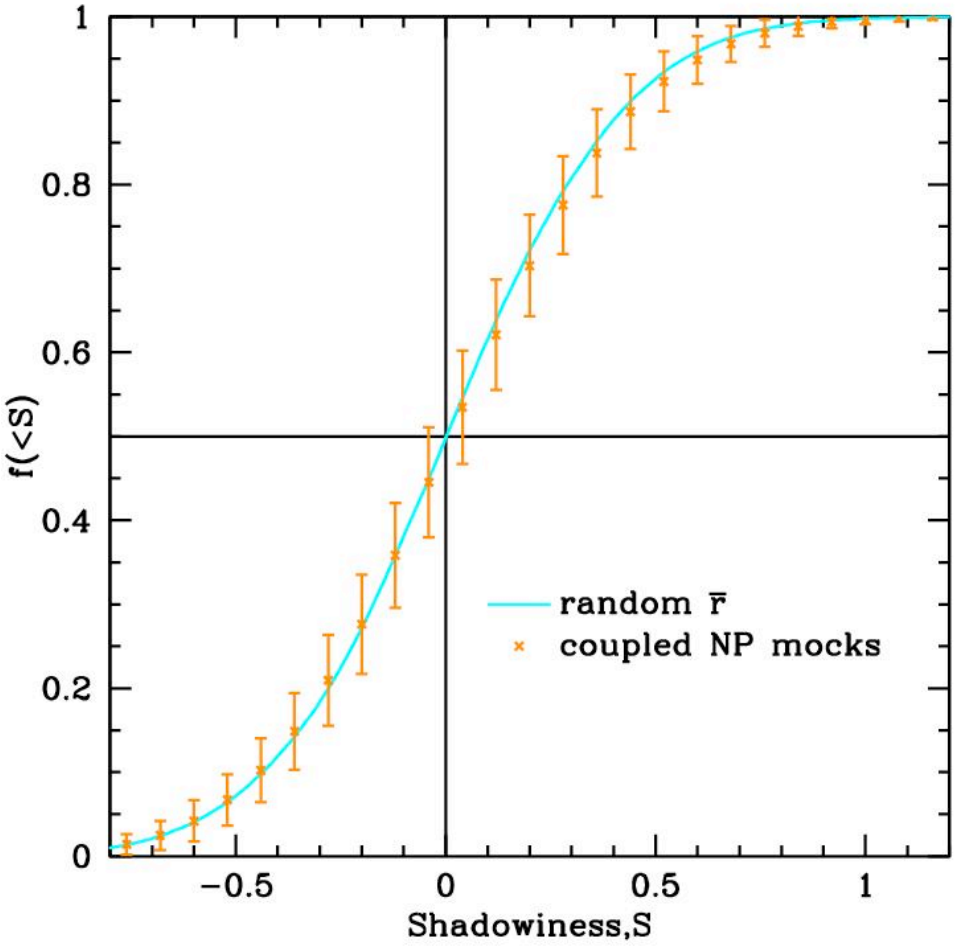
Stacked reduced residuals



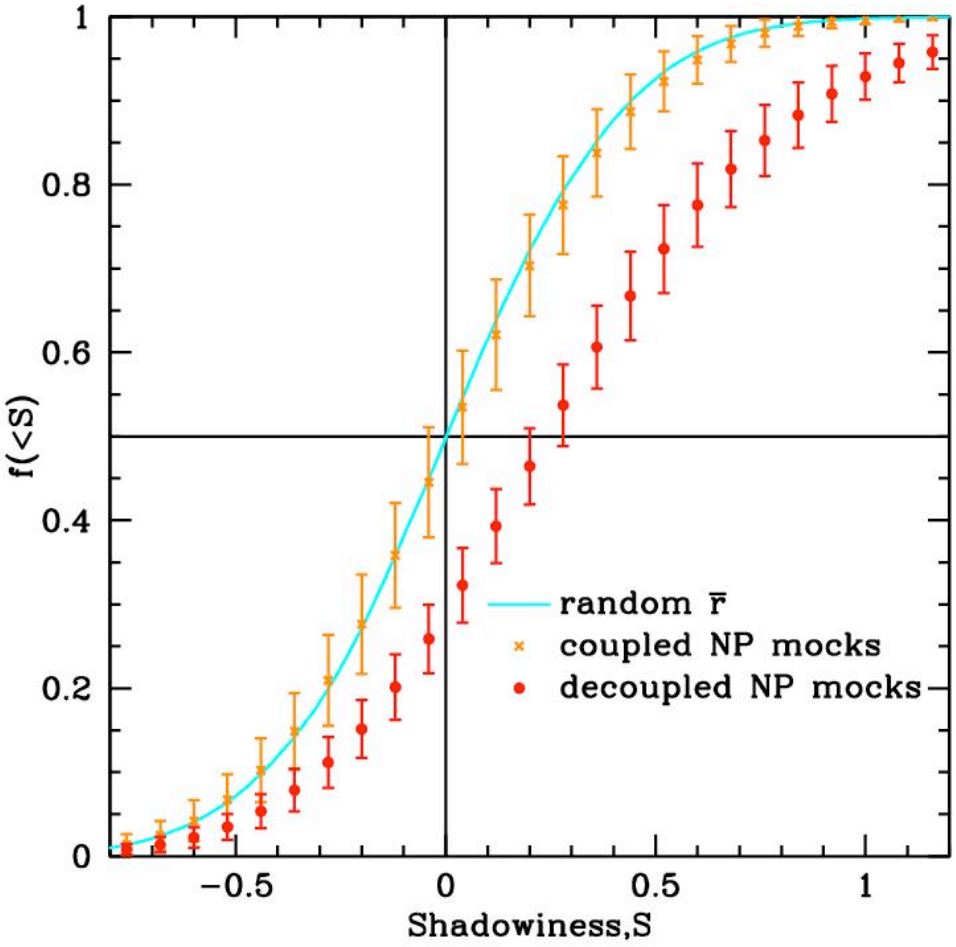
Shadowiness distributions



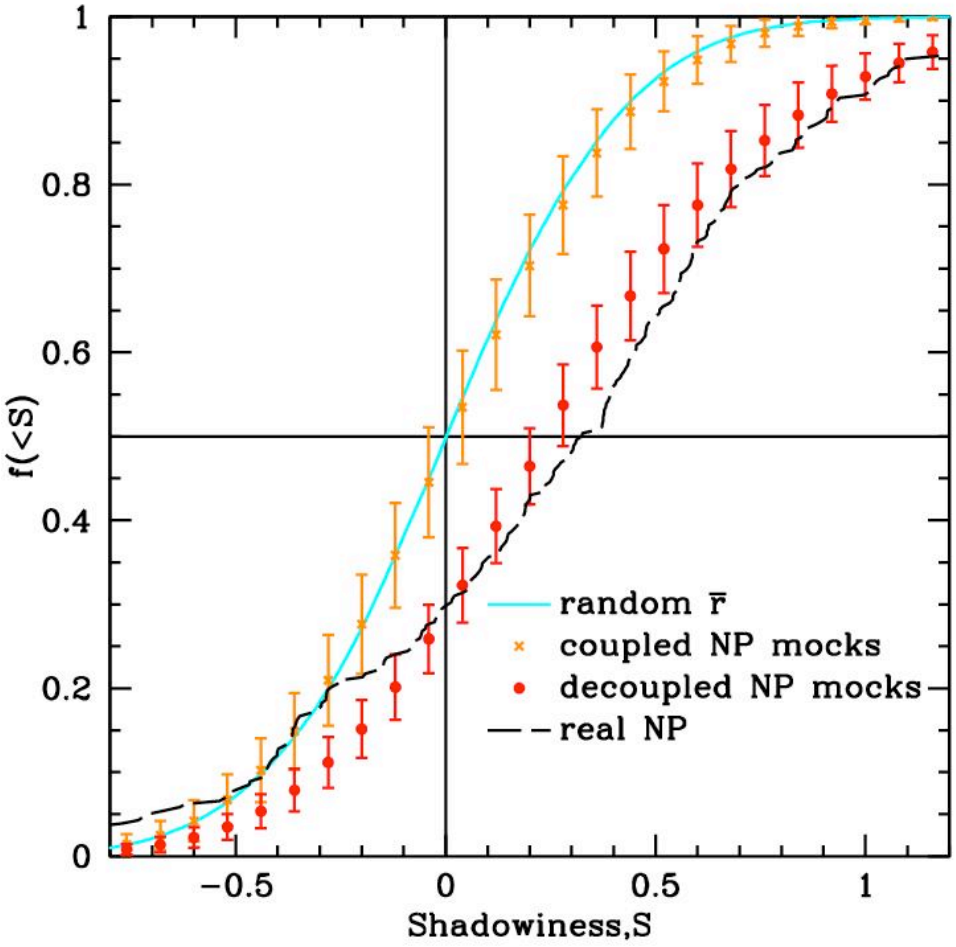
Shadowiness distributions



Shadowiness distributions



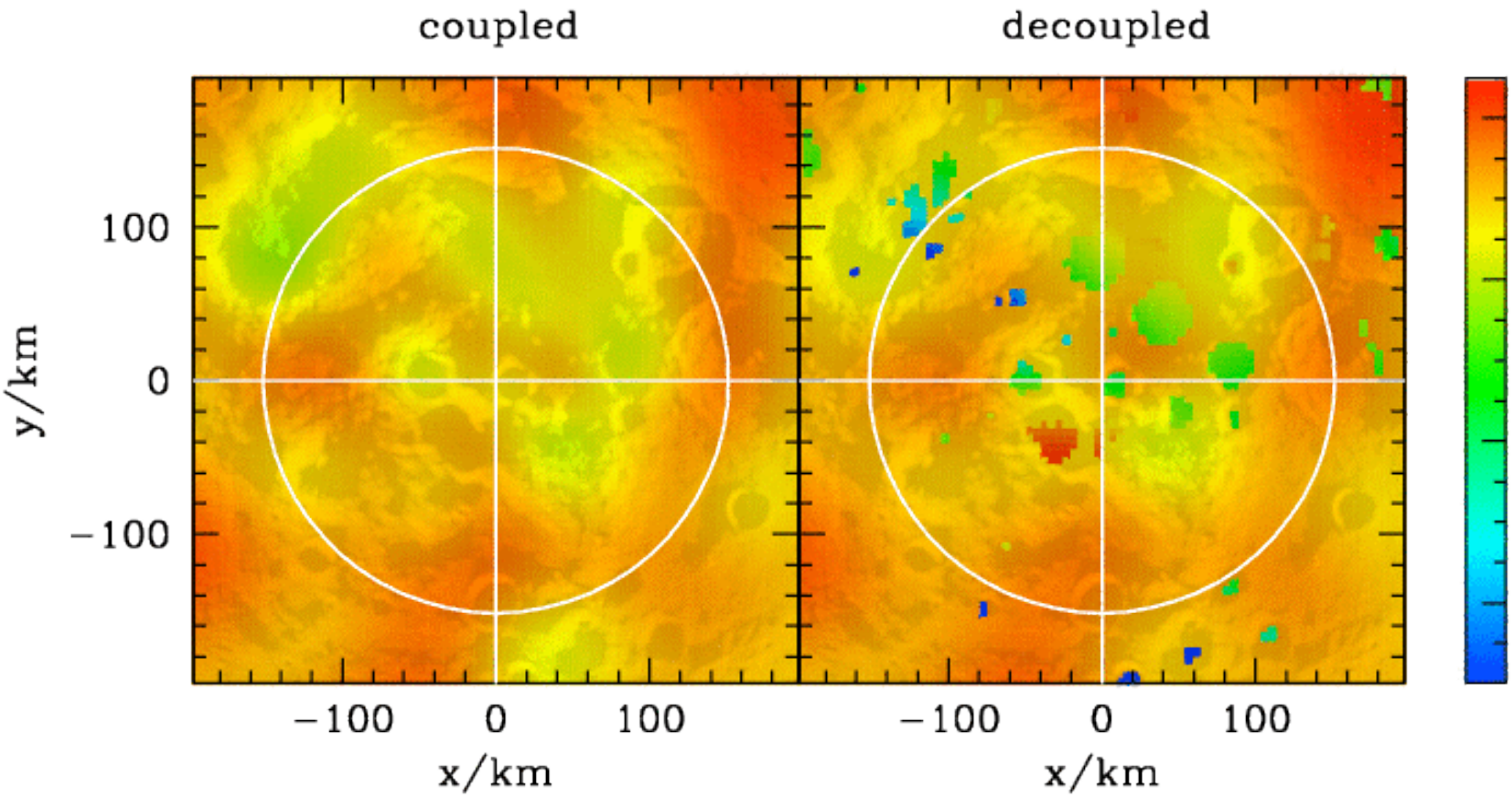
Shadowiness distributions



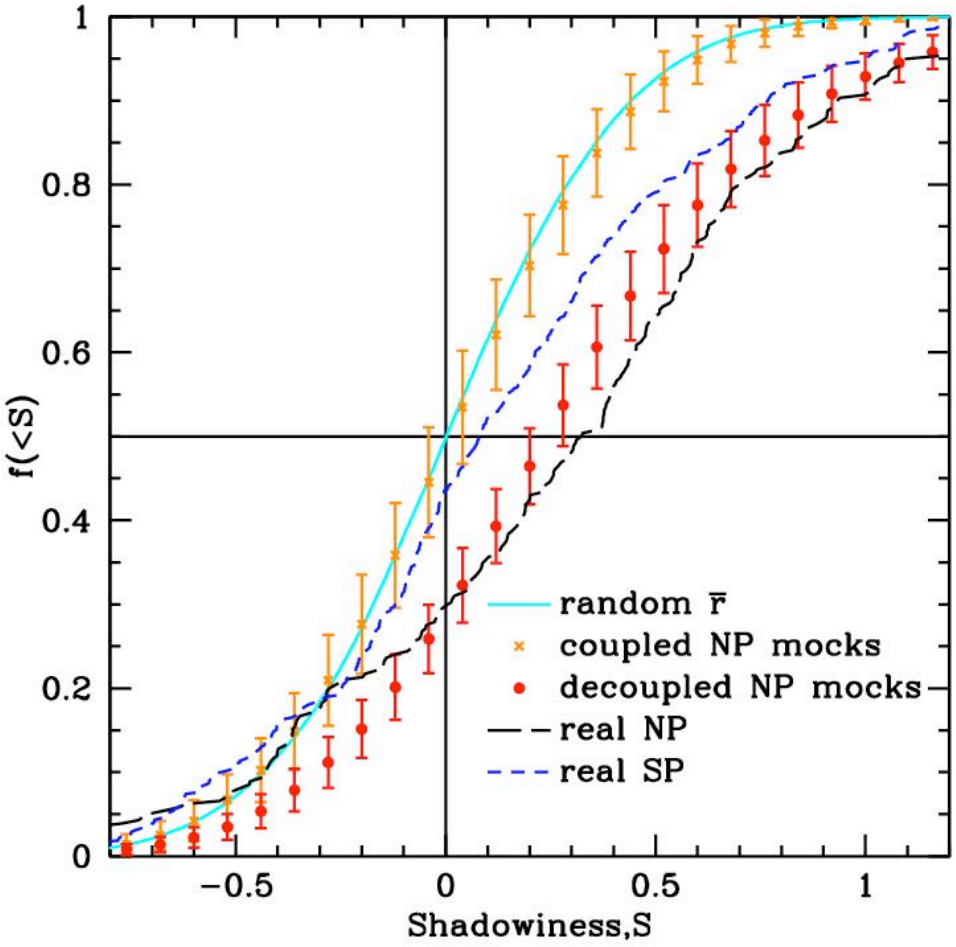
Conclusions

1) The Lunar Prospector data alone places the excess H into permanently shaded craters.
2) The implied concentrations reach ~1% water-equivalent H.
3) Including both poles, there is ~2.10^{11}kg H_2O within 10 degrees of the lunar poles (Lake Havasu holds ~800 billion litres).

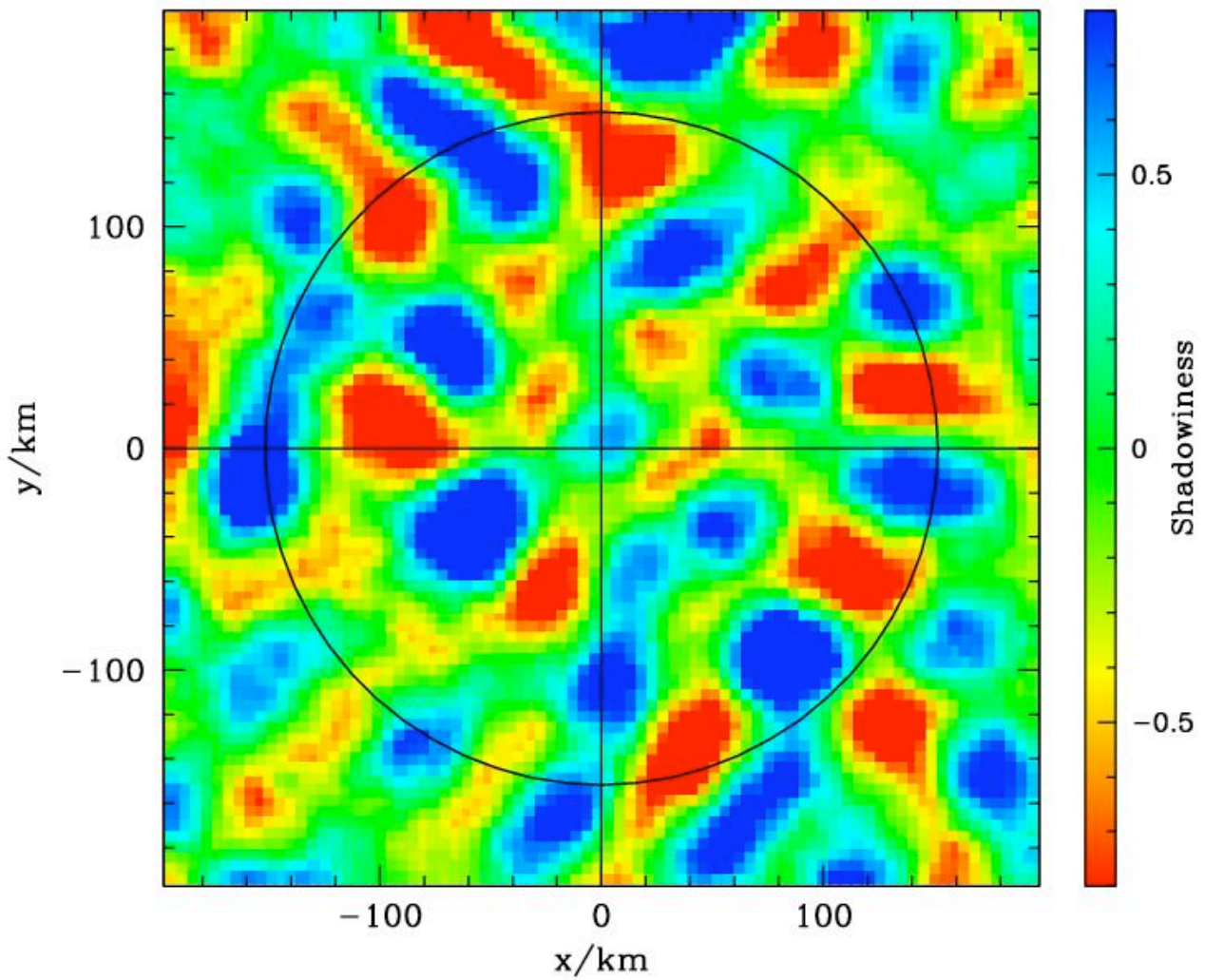
South Pole reconstructions



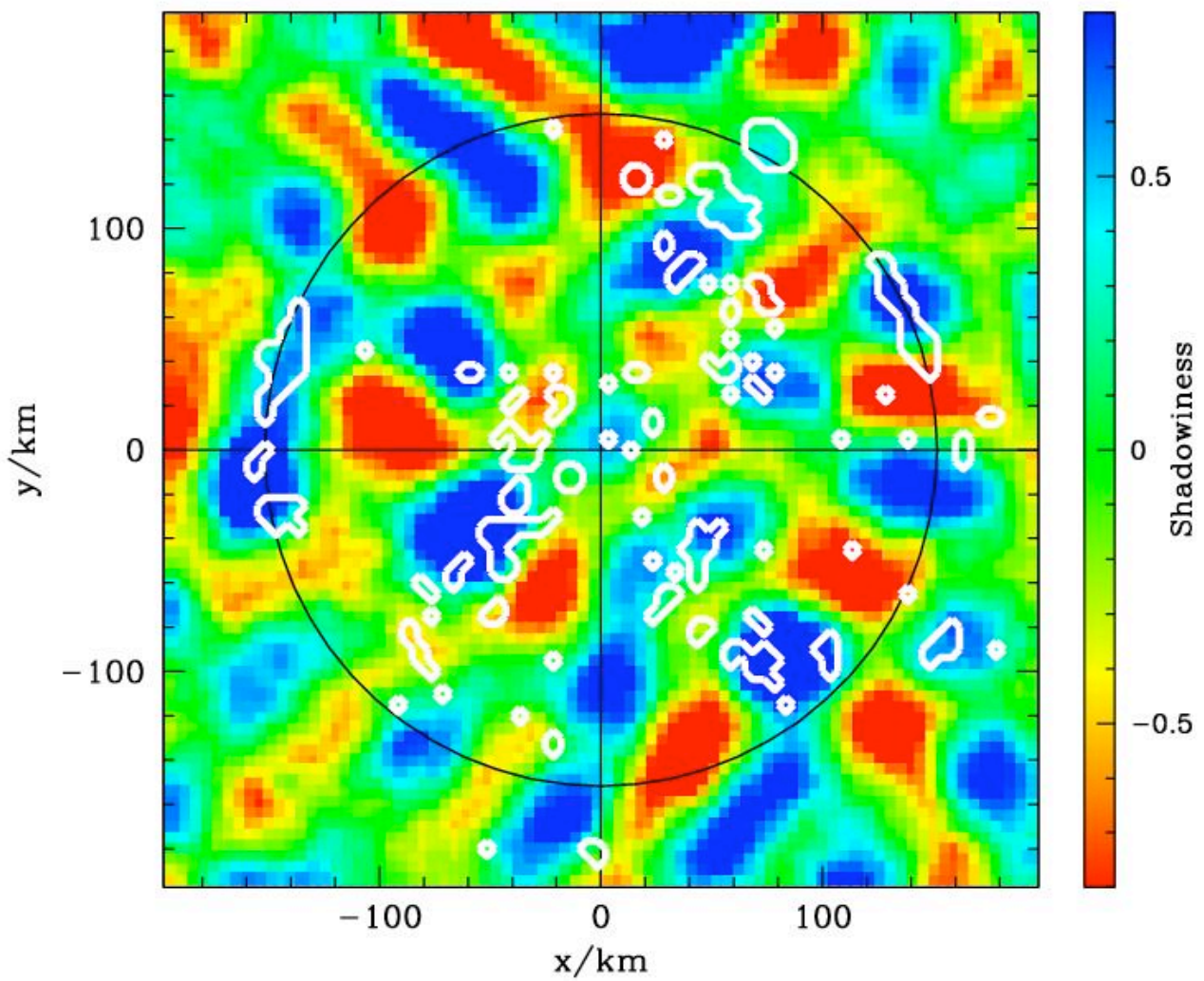
Shadowiness distributions



NP Shadowiness map



NP Shadowiness map



The problem: D=T*B+N

$$p(D) = 1, p(M) = \text{constant, don't prejudge}$$

$$\therefore p(T_e \cap M \mid D) \propto p(D \mid T_e \cap M) p(T_e \mid M)$$

$p(D \mid T_e \cap M)$: **the likelihood**

$p(T_e \mid M)$: **the image prior**

Pixon-based image reconstruction technique